Interventions to Reduce Pain during Vaccination in Infancy

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Objective To investigate interventions that affect pain reduction during vaccination in infants and children attending a well-child unit.

Study design A consecutive sample of 243 children between age 0 and 48 months receiving their routine vaccinations was randomly assigned to 1 of the study groups. A total of 158 infants under age 6 months were randomly assigned to breast-feeding or no breast-feeding during immunization, and 85 children age 6 to 48 months were randomly assigned to receive 12% sucrose solution, lidocaine-prilocaine cream, or no intervention. All children were evaluated for crying time and pain score by a pediatrician using the Neonatal Infant Pain Scale (NIPS) for those under age 12 months and the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) for those over age 12 months.

Results Breast-feeding in infants under age 6 months and use of sucrose or lidocaine-prilocaine in children age 6 to 48 months significantly reduced crying time and pain scores compared with controls. No difference in outcome was seen between the sucrose and lidocaine-prilocaine treatment groups.

Conclusions Here we expand on previous findings by demonstrating that breast-feeding may have an analgesic effect up to age 6 months and that in older children, both sucrose and lidocaine-prilocaine reduce vaccination pain. *(J Pediatr 2009;154:385-90)*

In the developed world, the most common painful procedure performed in infants is vaccination, a process involving repeated injections in the first 2 years of life.[1] Even young children have a pain memory, causing them to anticipate painful procedures and to react more intensely if they have undergone previous painful procedures with inadequate analgesia.[2-5]

To meet stricter requirements for gentle handling, evaluating various pain- reduction strategies is important.[6] Recent studies have shown that breast-feeding has an analgesic effect during acute, short-lasting, repetitive painful procedures in term newborns.[7-11] To the best of our knowledge, there has been no study investigating the analgesic effect of breast-feeding on pain reduction during minor procedures beyond the newborn period.

Sucrose water (12% to 50%) and other sweet solutions administered just before a procedure have been shown to decrease the pain associated with procedures in neonates.[10-12] It has been suggested that sucrose loses its efficacy by age 4 to 6 months, however.[13]

Topical anesthetics have been shown to reduce the pain of both subcutaneous and intramuscular injections. Lidocaine-prilocaine is safe and does not alter the immunogenicity of vaccines.[14,15] Unfortunately, however, the delayed onset of action of lidocaine-prilocaine cream (~1 hour) limits its applicability during routine vaccinations.

The primary aims of the present study were to investigate the analgesic effect of breast-feeding in infants age 0 to 6 months and to compare the analgesic effects of sucrose solution and lidocaine-prilocaine cream in children 6 to 48 months. The secondary aim was to investigate the possible risk factors associated with higher pain scores, such as age, sex, maternal education, socioeconomic level, previous pain experience, maternal distraction, injection site and technique, needle length, and number of injections.

METHODS

Approval to perform the study was granted by the Ethics Committee of Ankara Training and Research Hospital. The aim, risks, and possible benefits of the study were explained to the mothers, and informed consent was obtained from each.

CHEOPS	Children's Hospital of Eastern Ontario Pain Scale	NIPS	Neonatal Infant Pain Scale
CI	Confidence interval	OR	Odds ratio

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Inclusion Criteria

A total of 250 healthy infants and children receiving their regular vaccinations between age 0 and 48 months attending the well-child unit of the Department of Pediatrics were recruited and randomized for the study. Overall, 243 infants were analyzed. In Turkey, the routine vaccination schedule includes single injections at 0 to 2 weeks, 1 month, 6 months (hepatitis B vaccine), and 12 months (measles-mumps-rubella vaccine) and multiple injections at 2 months (bacillus Calmette-Guérin vaccine, diphtheria-tetanus-pertussis and inactive polio vaccine, and *Hemophilus influenzae* b vaccine), 4 months, 6 months, and 16 to 24 months (diphtheria-tetanus-pertussis, inactivated polio virus vaccine, and *H influenzae* b vaccine). Although pneumococcus, varicella, influenza, and hepatitis A vaccines are not included in routine vaccination schedule, these vaccines can be purchased by the parents and administered according to American Academy of Pediatrics recommendations.

Exclusion Criteria

Infants with intercurrent illness born at less than 37 completed weeks' gestation who were unable to tolerate fluids by mouth, had an allergy to any component of the anesthetic used in the study, or had a diagnosis of cerebral palsy (in whom the response to painful stimuli may be difficult to interpret) were excluded.

Randomization

A consecutive sample of 243 infants and children age 0 to 48 months receiving routine vaccinations were randomly assigned by the first assistant to 1 of the study groups, stratified by age using sealed envelopes. All infants under age 6 months who were exclusively breast-fed were randomly assigned to breast-feeding or no breast-feeding during immunization. Masking of the intervention was not possible. Children age 6 to 48 months were randomly assigned to receive 12% sucrose solution, lidocaine-prilocaine cream, or no intervention (Figure). The subjects were not allowed to receive anything orally (eg, sucrose, water, juice, formula, pacifier) during the procedure. The mothers were not allowed to breast-feed the older infants.

The pediatrician responsible for recording the crying time and pain score was not present during the interventions and was blinded to each subject's allocation except to the breast-feeding group.

Sociodemographic and Clinical Characteristics

The subjects' age and sex were recorded. Participating mothers were asked questions about educational and socioeconomic level. Educational attainment was classified as "no formal schooling: illiterate," "primary education," "secondary education," or "university education." Socioeconomic level was classified according to monthly household income and the official 2004 poverty thresholds of the Turkish Statistical Institute (http://www.tuik.gov.tr). Pain experience during previous vaccination was noted.

Procedures

The mother was seated with the infant or child in her arms. All infants and children were awake during the procedure. Any verbal distraction by the mother during vaccination was recorded. Injection site, injection technique, needle length, and injection number also were recorded on prepared forms by the research assistant.

Breast-feeding group. The study was initiated when the infant maintained a good latch, as determined by a large amount of areola in the mouth, flanged lips, and active jaw movement. Achieving this generally took 30 to 60 seconds. The mother was asked to continue breast-feeding the infant during the procedure. Four infants failed to complete the study because they did not resume feeding.

Sucrose group. The mother was instructed to hold the infants across her lap in a cross-cradle position while ensuring that the infant's arms or thighs were accessible throughout the procedure. Sucrose solution (12%) was placed in oral syringes by a pharmacist. Two minutes before the injection, the sucrose-allocated group received 2 mL of 12% sucrose solution orally, as described by Allen et al.[15]

Lidocaine-prilocaine group. One gram of lidocaine-prilocaine was applied to the vaccination area (lateral region of the right thigh or deltoid) 1 hour before vaccination.[16] The cream was covered with an occlusive dressing (Tegaderm; 3M, Minneapolis, Minnesota) for 1 hour. Vaccinations and related interventions were performed in a separate warm and quiet room. All vaccinations were performed by the same experienced nurse.

Outcome Measures

Crying time. Crying from the moment of needle insertion until all crying activity had ceased was recorded by the pediatrician.

Pain responses. Two pain scales were used to assess vaccination pain on an objective scale[17,18]:

- Neonatal Infant Pain Scale (NIPS). Pain responses were assessed with the NIPS in infants under age 12 months.[19] The tool consists of 6 categories (facial expression, cry, breathing pattern, arm and leg movements, state of arousal), scored dichotomously, with 2 descriptors in each category. The NIPS was translated into Turkish by Akdovan, and the validity and reliability of the scale was confirmed by the same author in a study on 180 infants.[19-21] NIPS forms were completed by the pediatrician. A score above 3 indicates pain; the maximum score is 7.
- Children's Hospital of Eastern Ontario Pain Scale (CHEOPS). This scale, developed in 1985 by McGrath et al,[22] is used for